A weighty matter: Identification and management of overweight and obesity in adolescents

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Overweight and obesity are common in South African boys (18.8%) and girls (26.3%). Considering the potential serious consequences of these conditions, clinicians need to identify overweight and obese adolescents to enable early diagnosis and treatment. The key contributor in adolescents is increased intake of unhealthy foods and lower levels of physical activity. The consequences of overweight and obesity in adolescence are multisystemic and include cardiometabolic (type 2 diabetes mellitus, high blood pressure, dyslipidaemia), respiratory (obstructive sleep apnoea), gastrointestinal (non-alcoholic fatty liver disease), musculoskeletal, psychological (depression) and social (stigmatisation) effects. Body mass index (BMI) is calculated to determine overweight and obesity in adolescents. Numerous expert committees, despite using different methods, classify overweight and obesity in children by age- and gender-specific cut points for BMI. After a diagnosis of overweight and obesity, secondary causes must be excluded, and a history of dietary intake, physical activity and sedentary behaviour obtained. This will identify modifiable behaviours that promote energy imbalance. All obese adolescents should undergo cardiometabolic assessments comprising fasting glucose, lipid and blood pressure measurements every 2 years. Interventions should focus on creating healthier home environments that provide easy access to healthy foods, encourage physical activity and discourage sedentary behaviour. Medication for weight loss or bariatric surgery may be considered for severely obese adolescents who do not respond to other strategies.

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Overweight and obesity

Prevalence

Over the past few decades, the prevalence of overweight and obesity in children and adolescents has increased rapidly.[1] In 2013, the prevalence in South African (SA) boys and girls <20 years of age was 18.8% and 26.3%, respectively.[2] With almost 1 in 5 boys and a quarter of girls in SA being overweight and obese, this represents a major burden of a serious and preventable disease in children and adolescents.

In view of the potentially serious consequences, it is vital for the clinician to identify overweight and obese adolescents timeously to ensure an early diagnosis, screening for comorbidities and the implementation of appropriate management strategies.

Determinants

The development of overweight and obesity is a complex and multifaceted interplay between genetic, epigenetic, environmental and behavioural factors. Individual differences determine the degree of susceptibility to overweight and obesity.[1] Although weight regulation is influenced by immunological, neural, hormonal, metabolic and other mechanisms, genetic factors and genetic-environmental interactions are thought to be among the more important ones.[3] Factors that influence susceptibility to an obesity-conducive environment include environmental dynamics, lifestyle choices, and cultural and sociological factors, in addition to a genetic predisposition.

The key contributor to overweight and obesity in adolescents, similar to that in adults, is the emergence of the 'obesogenic' environment.[1] There have been alterations in adolescents' dietary and physical activity patterns, with the overconsumption of food, particularly calorie-dense foods, and decreases in physical activity with increases in sedentary behaviours, such as more 'screen time' (television, computer and video games). This has led to an energy imbalance between calories consumed and calories expended, with more calories consumed than expended. The subsequent accumulation of abnormal or excessive fat presents a risk to health and is the hallmark of overweight and obesity.

Comorbidities

Overweight and obesity in adolescence are multisystem diseases with potentially devastating consequences that affect both physiological and psychosocial wellbeing. Chronic conditions that were once considered diseases of middle age are now prevalent in adolescents because of the rise in childhood obesity.[1] The onset of these conditions in childhood implies greater life-years lost than if the onset was in adulthood.

Obesity in adolescents, as in adults, is associated with a higher risk of the development of insulin resistance and type 2 diabetes mellitus. The latter accounts for almost 50% of diabetes in children and adolescents.[4,5] Most of the major risk factors for cardiovascular diseases, e.g. high systolic and diastolic blood pressure (BP), manifest during this period, although the endpoints, such as ischaemic heart disease and stroke, are not necessarily evident in adolescence. Overweight is probably the most significant factor associated with elevated BP in childhood, responsible for >50% of the risk of developing hypertension.[6] About 13% and 9% of overweight children have raised systolic and diastolic BP, respectively.[5] Dyslipidaemia (raised low-density lipoprotein cholesterol (LDL-C), increased triglycerides, and low high-density lipoprotein cholesterol (HDL-C)) is one of the most common medical abnormalities in overweight adolescents.[3,5] It is a causal factor in the development of atherosclerotic vascular lesions by late adolescence.[4]

Moreover, overweight and obesity have wide and far-reaching consequences involving multiple systems, such as the respiratory

and gastrointestinal systems, and orthopaedic problems.[1,3-5] Importantly, overweight and obesity in adolescents are associated with numerous adverse psychosocial effects (Table 1).

Identification

Numerous techniques may be used to determine adiposity in adolescents. The commonly used measure is the calculation of body mass index (BMI), where the person's weight in kilograms is divided by their height in metres squared (kg/m²). BMI is a good proxy to measure adiposity in adolescents because it correlates with body fat and denotes an increased risk of adverse health outcomes, particularly cardiometabolic diseases.[5] The BMI guidelines to diagnose overweight and obesity in childhood are those of the International Obesity Task Force (IOTF) standards, described by Cole *et al.*,[7] the World Health Organization (WHO), and the Centers for Disease Control and Prevention (CDC) (2000) (Table 2).[8]

The IOTF method uses age- and gender-specific cut points in 2 - 17-year-old children to predict a BMI of ≥25 kg/m² (overweight) and ≥30 kg/m² (obesity) at 18 years of age. Children defined as obese are also included in the overweight category. The international age- and gender-specific child BMI cut points were derived from a large international sample that used regression techniques by passing a line through the health-related adult cut points at 18 years.[7]

The WHO has child growth references for 5 - 19-year-olds where *z*-score values for BMI-for-age are calculated using WHO software.[9] Overweight and obesity are defined as ≥1 standard deviation (SD) and ≥2 SD, respectively.

The CDC (2000) uses charts to identify overweight and obese children and adolescents,[8] where BMI levels are compared with those of their peers of the same sex and age. National survey data collected from 1963 - 1965 to 1988 - 1994 were used to determine the overweight and obesity percentiles for each age and sex. Clinical overweight correlates with BMI >85th centile and obesity with BMI >95th centile.[10]

There are other measures of overweight and obesity that do not use weight and height in adolescents, which may add value in defining visceral fat and body composition; however, few have paediatric norms while others are expensive or impractical in clinical practice.[4,8] Although BMI and waist circumference are highly correlated and the associations with visceral adiposity are of similar magnitudes,[11] reference cut points for waist circumference in adolescents that identify risk beyond that provided by BMI category are not available.[5] The cheapest but least reproducible is the measurement of skinfold thickness using calipers; this is therefore not recommended in routine clinical care.[5] Other measures, generally limited to the research setting, include electrical impedance techniques, hydrodensitometry (underwater weighing), computed tomography, magnetic resonance imaging, and dual-energy X-ray absorptiometry.[4,8]

Table 1. Some comorbidities associated with overweight and obesity [1,3-5]

Category	Comorbidity
Psychological	Lack of confidence, low self-esteem, anxiety and depression, behavioural disorders
Social	Stereotyping, stigmatisation, discrimination, social rejection and isolation, loneliness, school avoidance and poor academic performance, victim or perpetrator of bullying behaviour, substance abuse
Disordered eating	Overeating, binge eating, bulimia nervosa, night-eating syndrome
Respiratory	Asthma, obstructive sleep apnoea, obesity hypoventilation syndrome
Orthopaedic	Hip, knee and ankle pain from musculoskeletal stress, slipped capital femoral epiphysis, Blount's disease
Gastrointestinal	Non-alcoholic fatty liver disease, gastro-oesophageal reflux disease, constipation, gallbladder disease
Gynaecological	Oligomenorrhoea or amenorrhoea due to polycystic ovarian syndrome, early onset of puberty in girls
Neurological	Headaches due to pseudotumour cerebri

Clinical assessment

Once overweight and obesity have been diagnosed, it is imperative to determine the aetiology and associated morbidities. A thorough medical examination, followed by a nutritional assessment, is required. The medical examination should include screening for signs of secondary causes of obesity, some of which are listed in Table 3.[12] These may be excluded clinically; an endocrine cause is particularly unlikely if there has been no delay in linear growth.[4,5] In the absence of dysmorphic features and developmental delays, a genetic cause is unlikely. If a secondary cause is not probable, the adolescent and the parents, who often seek a medical cause, should be reassured that no further workup is necessary. Nevertheless, they must be made aware of the need to screen for comorbidities and to initiate treatment without delay.

Following the exclusion of a secondary cause of obesity, obtaining a dietary, physical activity and sedentary behavioural history is important.[4,5] The purpose is twofold: (*i*) to identify the behaviours that promote energy imbalance and are modifiable; and (*ii*) to assess the capacity of the adolescent and their family to change these behaviours.[5]

A dietary history includes an assessment of the frequency of intake of sugared beverages and fast foods, and the contents of school lunches.[4] However, cognizance must be taken of the limitations associated

Table 2. Methods for determining overweight and obesity in adolescents using BMI[7,9,10]

		Cut points	
Adiposity indicator	**Calculation method**	**Overweight**	**Obesity**
International Obesity Task Force	Age- and gender-specific cut points predict BMI at 18 years	BMI ≥25 kg/m²	BMI ≥30 kg/m²
World Health Organization	Software used to obtain *z*-scores; equivalent to BMI at 19 years	*z*-score ≥1 SD; corresponds to BMI ≥25 kg/m²	*z*-score ≥2 SD; corresponds to BMI ≥30 kg/m²
Centers for Disease Control and Prevention	Age- and gender-specific charts	BMI ≥85th centile	BMI ≥95th centile

SD = standard deviation.

with self-reported food intake. A history of risky eating behaviours, such as purging or diet pill use, binge eating and late-night eating, should also be determined, as these frequently coexist with obesity.

The time spent on physical activity and sedentary behaviours, such as watching television and playing computer games, needs to be documented. Decreased physical activity has been related to overweight in early adolescence,[4] while television viewing time, as a proxy for sedentary behaviour, correlated with rising BMI and the development of diabetes.[4]

The presence of comorbidities, particularly obstructive sleep apnoea, orthopaedic and psychosocial problems, should be elicited on history and examination of overweight and obese adolescents (Table 1).[4] Polycystic ovarian syndrome, with its increased future risk of diabetes and dyslipidaemia, is common in obese adolescent girls and needs to be considered in the assessment.

Table 3. Some secondary causes of adolescent overweight and obesity[12]

Category	Cause
Endocrine	Hypothyroidism Growth hormone deficiency Cushing's syndrome Pseudohypoparathyroidism
Syndromes	Down syndrome Prader-Willi syndrome Bardet-Biedl syndrome
Drug induced	Steroid treatment Secondary to sodium valproate
Genetic/ monogenic obesity	Leptin deficiency

The American Academy of Pediatrics recommends that all obese adolescents undergo cardiometabolic assessments every 2 years, comprising fasting glucose, lipid and BP measurements.[4,11] Cardiometabolic abnormalities and the metabolic syndrome are common with overweight and obesity, even during adolescence, and the appropriate cut points for diagnosis in the adolescent population are presented in Table 4.

The metabolic syndrome, comprising dysglycaemia, dyslipidaemia, raised BP and obesity, increases the risk of cardiovascular disease and diabetes and appears to be common in obese adolescents. Although three or more criteria (Table 4) are required for a diagnosis, there is currently no consensus on age-specific cut points for a diagnosis in adolescents.[4]

Management

Obesity should be considered a disease per se that warrants intervention, even in the absence of comorbidities.[13] However, owing to the multiple pathways involved in its development, i.e. environmental, social, behavioural, and biological roots, management of the disorder is extremely challenging, particularly in children and adolescents.[1]

A critical factor for success is motivation, which may be achieved through the use of motivational interviewing techniques.[1] This involves employing the four primary skills of asking, informing, advising and listening. Adolescents or parents are allowed to arrive at their own insights and decisions, rather than these being imposed on them. A recent randomised controlled trial by Resnicow *et al.*[14] demonstrated significant reductions in BMI using motivational interviewing techniques.[14]

Interventions should focus on creating healthier environments by providing opportunities for fun physical activities and easy access to healthy meals.[13] Parental involvement is considered critical in supporting change to the adolescent's lifestyle behaviours. This is achieved by creating an enabling home environment by providing easy access to healthy foods, encouraging physical activity and discouraging sedentary behaviour such as television viewing. Some recommended lifestyle changes are described in Table 5. To achieve and sustain such adjustments, obese adolescents require high levels of social support from family, friends and healthcare professionals.[5,13]

In addition to diet and activity, there is a third key component for successful obesity management, which is the psychology of the adolescent. Among the techniques to reinforce compliance and positive thinking are goal setting, self-monitoring, reinforcements, rewards, and peer mentoring.[1]

Medication for weight loss may only be considered for severely obese adolescents who have not responded to other strategies. However, a recent systematic review and meta-analysis of treatment of overweight and obese children and youth reported no difference in reductions in BMI and BMI *z*-scores between those on behavioural interventions alone compared with those on pharmacological plus behavioural interventions.[15] Notably, most weight-loss drugs have not been studied in the

Table 4. Diagnosis of cardiometabolic abnormalities in adolescents[4,5,11]

Condition	Symptoms and signs	Investigation	Diagnosis	Management
Diabetes	Asymptomatic, polyuria, polydipsia, weight loss, acanthosis nigricans	Fasting glucose 2-h glucose post OGTT Random glucose	≥7.0 mmol/L ≥11.1 mmol/L ≥11.1 mmol/L	Diet and lifestyle modification, metformin
Hypertension	Asymptomatic, headaches, dyspnoea, sweating	BP reading taken with appropriate cuff size on ≥3 separate occasions	Systolic and/or diastolic BP ≥95th percentile for age, gender and height	Diet and lifestyle modification, pharmacological agents if symptomatic
Dyslipidaemia	Xanthomata	Fasting lipid screen – total cholesterol LDL-C HDL-C Triglycerides	>4.7 - 5.2 mmol/L >3.4 - 4.1 mmol/L <1.0 mmol/L >1.7 - 2.3 mmol/L	Diet and exercise, pharmacological agents if LDL-C >4.9 mmol/L
Metabolic syndrome*	Specific to each condition of the syndrome	Waist circumference, triglycerides, HDL-C, BP, fasting glucose	Abdominal obesity plus ≥2 of the following: high triglycerides, low HDL-C, high BP, high fasting glucose	Treat each abnormality

OGTT = oral glucose tolerance test; BP = blood pressure; LDL-C = low-density lipoprotein cholesterol; HDL-C = high-density lipoprotein cholesterol.
*No consensus with regard to cut points in adolescents.

Table 5. Some recommended lifestyle changes[1,12]

Reduce energy intake – diet
Keep to regular meal times and eat small snacks
Eat more low-energy snacks, such as fruits and vegetables
Eat dinner as a family 5 - 6 times per week
Avoid eating while watching television
Avoid eating away from home, especially fast foods
Avoid high-energy foods, such as chips, chocolate, sweets
Avoid 'grazing'
Avoid sugary juices/sweetened drinks/soft drinks
Reduce portion sizes
Increase energy consumption – activity
Do more moderate to vigorous physical activity for 1 h/day
Do more walking/cycling instead of travelling by car or bus
Increase active leisure and weekend activities
Use stairs not lifts
Be more active around the home/garden, e.g. helping with domestic activities
Watch less television – limit to 2 h/day and no television viewing in the bedroom
Sit less – spend less time on computer-related leisure activities

adolescent population and should be used with caution. Another modality of treatment to consider for severe refractory obesity in adolescents is bariatric surgery, either gastric bypass or gastric banding.[4,5] However, there is a dearth of data on the long-term effects of such surgery, as longitudinal studies conducted in large samples are not available.[4]

Obesity intervention, apart from a positive change in body composition, has beneficial effects on the cardiometabolic profile of adolescents. Even with small changes in BMI, improvements in lipid profile, BP and insulin resistance have been noted.[13] Therefore, weight loss, healthier dietary habits and increased physical activity are mandatory for the improvement of cardiometabolic disorders in adolescents. However, pharmacotherapy should be considered for hypertension >99th percentile, LDL-C >4.9 mmol/L and diabetes not responding to lifestyle changes.[4]

Conclusion

Overweight and obesity in adolescents have serious long-term consequences and are highly likely to track into adulthood.[1] However, obese adolescents who revert to normal adiposity have the same risk of developing diabetes, hypertension and dyslipidaemia in adulthood as those who were never obese.[11] Therefore, it is essential that this condition be diagnosed early and managed holistically to ensure a successful outcome. This is particularly relevant in view of the increasing prevalence of adolescent obesity in SA.[3]

Overweight and obesity in adolescence are difficult to manage. Therefore, healthcare professionals need to have a thorough scientific background and understanding of the obese adolescent with regard to the physical, emotional, cognitive and physiological barriers facing them.[13] Furthermore, the primary care clinician plays a central role in preventing the development of overweight and obesity by promoting healthy lifestyle behaviours in all children and adolescents.

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